



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : B41C 1/10, B41J 2/01		A1	(11) International Publication Number: WO 94/11191 (43) International Publication Date: 26 May 1994 (26.05.94)
<p>(21) International Application Number: PCT/US93/11030</p> <p>(22) International Filing Date: 15 November 1993 (15.11.93)</p> <p>(30) Priority data: 07/977,316 17 November 1992 (17.11.92) US</p> <p>(71) Applicant: SUN CHEMICAL CORPORATION [US/US]; 222 Bridge Plaza South, Fort Lee, NJ 07024 (US).</p> <p>(72) Inventors: HALLMAN, Robert, W. ; 588 Windsor Drive, Palisades Park, NJ 07650 (US). SHIMAZU, Ken-ichi ; 494 Chappaqua Road, Briarcliff Manor, NY 10510 (US). ZHU, Hui ; 80 Crotty Avenue, Yonkers, NY 10704 (US).</p>		<p>(74) Agent: MATALON, Jack; 222 Bridge Plaza South, Fort Lee, NJ 07024 (US).</p> <p>(81) Designated States: CA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	
<p>(54) Title: APPARATUS FOR FABRICATION OF PRINTING PLATES</p> <p>(57) Abstract</p> <p>An apparatus for fabricating printing plates (15), e.g. lithographic or offset printing plates. The apparatus comprises processing means for digitizing an image, at least one assembly having at least one ink jet printing head (12) and operatively connected to the processing means, control means (11) operatively connected to the processing means and the assembly for supplying digital information to the assembly to project the digitized image upon the printing plate (15), and drive mechanisms (17, 18) operatively connected to the control means (11) and the assembly for controlling ink jetting movement of the printing head (12). An x-y table (14) is preferably also present for carrying the printing head (12) for planar movement with respect to the printing plate (15). The movement of the table (14) permits the printing of multiple pages (16a, 16b, 16c) upon large lithographic plates (15).</p>			

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APPARATUS FOR FABRICATION OF PRINTING PLATES

Field of the Invention

The present invention relates to an apparatus for the fabrication of printing plates, using ink jet printing heads. The invention is especially useful for
5 the fabrication of large, commercial grade, high production run lithographic and offset printing plates.

Background of the Invention

Recently, fabrication of lithographic or offset plates by ink jet techniques has been proposed. One such
10 technique is disclosed in Japanese patent application, Kokai 62-25081. This application describes the use of an ink jet system for applying an oleophilic liquid to form an image on the hydrophilic aluminum surface of a lithographic plate.

15 United States patent no. 4,833,486 discloses the use of an ink jet head to deposit a hot wax upon the surface of an offset plate. The hot wax solidifies upon contact with the lithographic plate, thus providing an instantaneous printing pattern.

20 There are several advantages for fabricating printing plates by ink jet printers. One advantage is that such processes are environmentally friendly. The complex and potentially polluting chemical preparations and solvents ordinarily used in masking and stripping away photoresist areas of the plates are not always required with ink jet techniques.
25

Another advantage of fabricating printing plates using ink jet printers resides in the fact that the image

deposited on the plate can be modified on the computer screen prior to being deposited. In addition, several of the standard imaging steps can be eliminated by forming the image using computer techniques.

5 Ink jet technology is, however, in its infancy in respect to commercial lithography. Presently available ink jet techniques cannot produce large or commercially acceptable offset plates. That is, the plates produced by present ink jet printing techniques have very low
10 plate runs by commercial lithographic standards. Furthermore, there is no ink jet apparatus presently available for fabricating large offset plates having a plurality of pages disposed thereon.

Indeed, U.S. Patent 4,833,486 teaches that ink jet materials are inexpensive and therefore, the printing plates may be used a minimum number of times and then discarded. Moreover, in one embodiment of the '486 patent, it is indicated that the system is designed for non-commercial plate production, inasmuch as an office processor system is proposed. Office processing systems ordinarily are not capable of providing the large amounts of digital information required to produce large, commercial lithographic plates.

25 A further drawback of the apparatus disclosed in the '486 patent is that it makes use of an ink jet medium which may be a wax. Wax is a soft material and will abrade with use under the conditions present for commercial offset printing. Even the so-called hard waxes will not provide the durability required for commercial printing runs of the order of 100,000 cycles. Moreover, waxes do not strongly bond to the printing plate surface, i.e. they prefer to remain on the surface, rather than to actively bond to the substrate.

5 In addition, the production of large lithographic printing plates requires the use of large amounts of digital information and precise, minute movements of the ink jet heads. Such movements can only be accomplished with the use of the controls employed in the present invention.

Summary of the Invention

10 The present invention contemplates an apparatus for fabricating printing plates, especially large, commercial-grade offset or lithographic printing plates. The present invention utilizes hydrophobic substances that are deposited on hydrophobic printing plates. Such hydrophobic substances accept waterless or oleic-type inks. It is within the scope of the present invention, 15 however, to coat the surface of a normally hydrophilic plate to render the surface hydrophobic. The present invention would then utilize hydrophilic compounds to form the image on the plate surface.

20 The apparatus of the present invention also contemplates the use of low viscosity fluids that harden upon the printing plate surface. Such materials will form tough images that strongly bond to the surface, thus providing an image that will endure tens of thousands of printing runs.

5 In commercial lithography, large printing plates are prepared with a plurality of pages. Often these pages are not sequentially disposed on the plate; in many cases, pages will appear upside down in respect to adjacent pages. Such type of print requires large amounts of computer information and precise ink jet movement across the face of the plate. The present invention utilizes the controls necessary for the

fabrication of large commercial lithographic and offset printing plates.

Summary of the Invention

In accordance with the present invention, there is provided an apparatus for fabricating printing plates. An image derived from digitized computer information is formed on the surface of a printing plate. The image is deposited on the plate in the form of ink jet droplets which are deposited from an ink jet printing head. The printing head, movable along "x" (horizontal) and "y" (vertical) axes, is mounted upon an assembly (table) which is also movable in the x-y plane. A pair of step motors, controlled by a computer, move the jet of the printing head along the "x" and "y" axes to position the ink jet droplets upon the plate surface. The table supporting the printing head is also movable in the x-y plane by means of electrical motors. The movement of the print head table provides for the printing of multiple pages upon large lithographic plates.

20 Brief Description of the Drawings

The present invention may be better understood by reference to the accompanying drawings, in which:

FIGURE 1 represents a schematic diagram of a control system employed in the present invention;

FIGURE 2 represents a schematic diagram of a variation of the control system of **FIGURE 1**; this control system is employed for fabricating large, commercial grade lithographic plates.

FIGURE 3 represents a schematic diagram of a variation of the control system of FIGURE 1 wherein the printing head moves only along the x axis.

5 FIGURE 4 represents a schematic diagram of a rotating drum system which replaces the x-y table shown in FIGURE 1.

For the purposes of brevity and clarity, like components and elements will bear the same designation throughout the figures.

10 Detailed Description of the Invention

The invention relates to an apparatus for fabricating printing plates. The apparatus comprises:

- (a) processing means for digitizing an image;
- (b) at least one assembly having at least one ink jet printing head and operatively connected to the processing means;
- (c) control means operatively connected to the processing means and the assembly for supplying digital information to the assembly to project the digitized image upon the printing plate; and
- (d) drive mechanisms operatively connected to the control means and the assembly for controlling ink jetting movement of the printing head.

25 Preferably, the apparatus contains a plurality of assemblies. Most preferably, each assembly contains a plurality of ink jet printing heads.

The preferred embodiment of the present invention relates to an apparatus comprising:

- (a) processing means for digitizing an image;
- (b) at least one assembly having at least one ink

jet printing head operatively connected to the processing means and having an x-y table for carrying at least one ink jet printing head for planar movement with respect to the printing plate;

5 (c) control means operatively connected to the processing means and the assembly for supplying digital information to the assembly to project the digitized image upon the printing plate and for controlling x-y planar movement of the assembly; and

10 (d) drive mechanisms operatively connected to the control means and the assembly for controlling ink jetting movement of the printing head.

15 FIGURE 1 depicts an ink jet printing head assembly for use with the apparatus of the present invention. The assembly is capable of producing lithographic plates of commercial quality since it is fast and accurate when depositing ink jet droplets.

It has been found that the Raster Image Processing (RIP) for lithographic ink jet processes, must be performed with large amounts of information in order to provide the high resolution required for commercially viable offset printing plates. Computer and control unit 11 utilized for converting large amounts of information into print head signals, includes a computer with large memory capacity and high speed calculation capability. Commercial plates require scanning a large plate surface and means for producing multiple pages as shown. Ink jet printing head 12 is often required to make subsequent scans in synchronization. This necessitates a very high degree of mechanical accuracy.

In order to provide high speed imaging, printing head 12 is mounted in an x-y table 14 such as an Opti-Copy Imposer x-y table or IPM Platemaker x-y table. In

ord r to scan the surfac of plate 15, comput r and control unit 11 provides digitally timed "x" (horizontal), "y" (vertical) ink jetting movement to print head 12 and planar x-y movement (shown by the "x" and "y" arrows in FIGURE 1) to table 14. Movement of table 14 is accomplished by drive mechanisms (not shown) and the "x" and "y" ink jetting movements of printing head 12 are provided by drive mechanisms 17 and 18, respectively (non-limiting examples of suitable drive mechanisms include step motors). After first page 16a is imaged, printing head 12 is subsequently moved to other positions on the surface of plate 15 in order to image subsequent pages 16b, 16c, etc. The imaging of the pages in not necessarily carried out in sequence. In fact, the pages are usually out of sequence, and may even be printed upside down with respect to adjacent pages.

FIGURE 2 illustrates a plurality of printing head assemblies. Each assembly will contain one or more printing heads 12 on an x-y table 14. The apparatus depicted in FIGURE 2 is capable of simultaneously printing multiple pages; multiple page printing is a necessity for large-scale printing operations.

FIGURE 3 is directed to the same apparatus as shown in FIGURE 1, except that printing head 12 moves in the x direction only.

In FIGURE 4, the x-y table is replaced by a rotating drum 19 which is controlled by computer control 11. Computer control 11 provides digitally timed ink jetting movement to printing head 12 and rotational movement to drum 19. Printing head 12 capable of planar movement in one direction only, i.e. horizontal or vertical, preferably horizontal. Drum 19 carrying printing plates 16a, 16b and 16c is capable of rotati nal movement in

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only a direction normal to that of printing head 12, i.e.
5 when printing head 12 moves in the horizontal ("x")
direction, drum 19 will rotate in the vertical ("y")
direction. The apparatus depicted in FIGURE 4 will
typically also include drive mechanisms (not shown)
operatively connected to the control means, assembly and
10 drum for controlling ink jetting movement of the printing
head and rotational movement of the drum.

WHAT IS CLAIMED IS:

1. Apparatus for fabricating a printing plate comprising:
 - (a) processing means for digitizing an image;
 - (b) at least one assembly having at least one ink jet printing head and operatively connected to said processing means;
 - 5 (c) control means operatively connected to said processing means and said assembly for supplying digital information to said assembly to project said digitized image upon said printing plate; and
 - (d) drive mechanisms operatively connected to said control means and said assembly for controlling ink jetting movement of said printing head.
2. The apparatus of claim 1 having a plurality of assemblies.
3. The apparatus of claim 2 wherein each assembly contains a plurality of ink jet printing heads.
4. The apparatus of claim 1 wherein the drive mechanisms comprise step motors.
5. Apparatus for fabricating a printing plate comprising:
 - (a) processing means for digitizing an image;
 - (b) at least one assembly having at least one ink jet printing head operatively connected to said processing means and having an x-y table for carrying at least one ink jet printing head for x-y planar movement with respect to the printing plate;
 - 10 (c) control means operatively connected to said processing means and said assembly for supplying digital information to said assembly to project said digitized

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image upon said printing plate and for controlling x-y planar movement of said assembly; and

15 (d) drive mechanisms operatively connected to said control means and said assembly for controlling ink jetting movement of said printing head.

6. The apparatus of claim 5 having a plurality of assemblies.

7. The apparatus of claim 6 wherein each assembly contains a plurality of ink jet printing heads.

8. The apparatus of claim 5 wherein the drive mechanisms comprise step motors.

9. Apparatus for fabricating a printing plate comprising:

(a) processing means for digitizing an image;

5 (b) at least one assembly having at least one ink jet printing head operatively connected to said processing means, said printing head being capable of planar movement only in a horizontal or vertical direction;

10 (c) a drum carrying the printing plate, capable of rotational movement only in a direction normal to that of the printing head;

(d) control means operatively connected to said processing means, said assembly and said drum for supplying digital information to said assembly to project 15 said digitized image upon said printing plate, for controlling planar movement of the printing head and for controlling the rotational movement of the drum; and

(e) drive mechanisms operatively connected to said control means, said assembly and said drum for 20 controlling ink jetting movement of said printing head and rotational movement of said drum.

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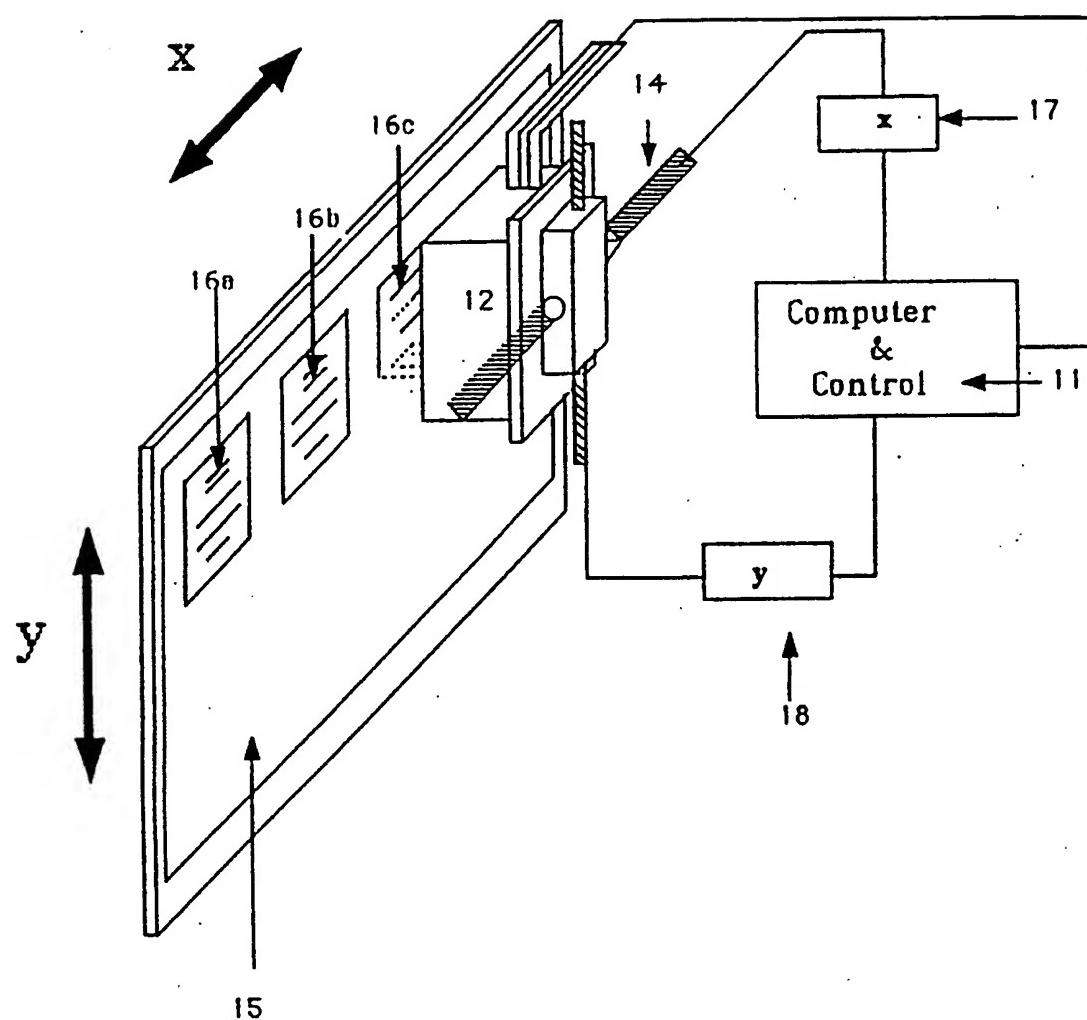
10. The apparatus of claim 9 having a plurality of assemblies.

11. The apparatus of claim 10 wherein each assembly contains a plurality of ink jet printing heads.

12. The apparatus of claim 9 wherein the drive mechanisms comprise step motors.

13. The apparatus of claim 9 wherein the printing head is capable of planar movement only in a horizontal direction and the drum is capable of rotational movement only in a vertical direction.

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**FIGURE 1****SUBSTITUTE SHEET**

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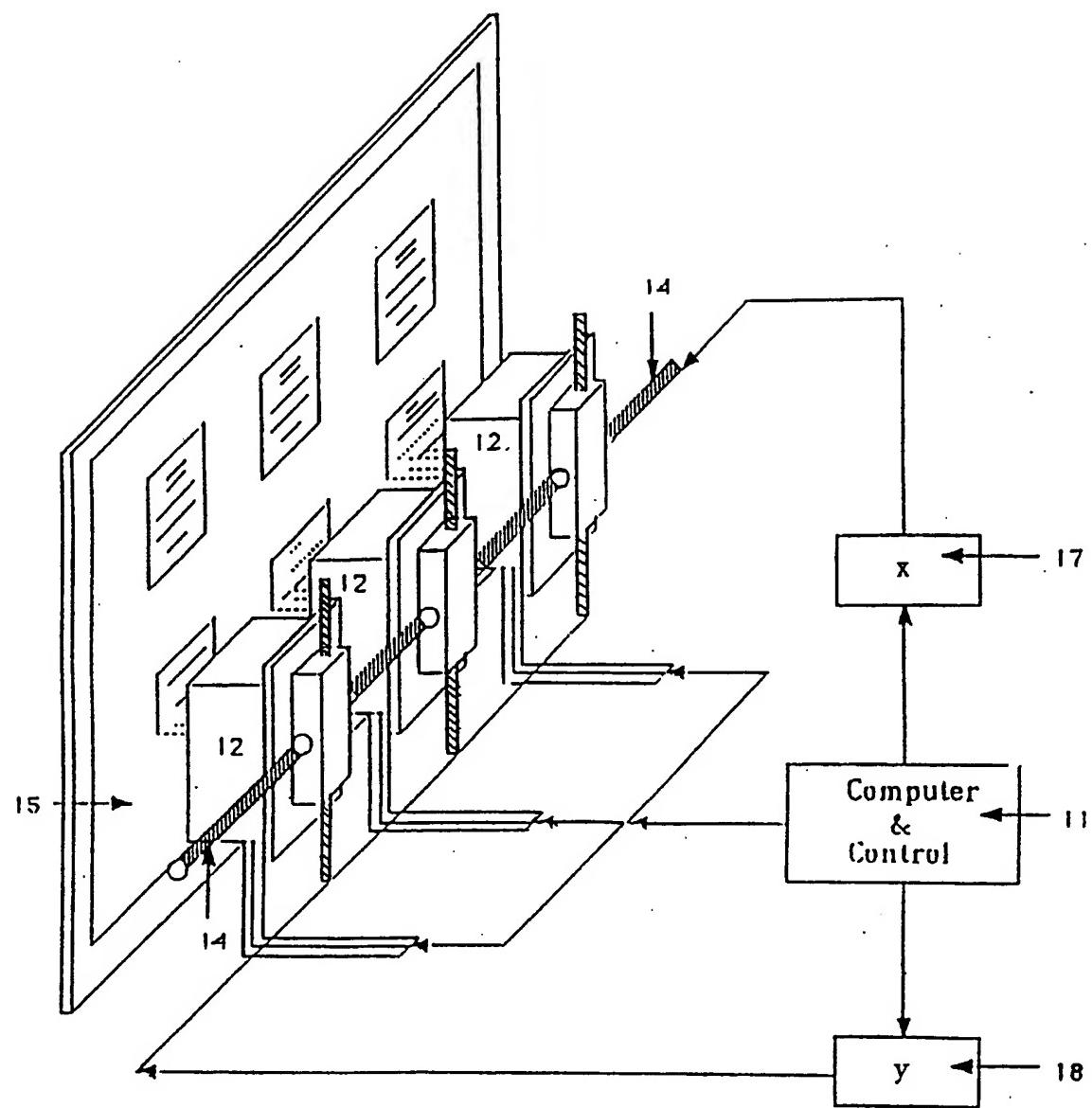


FIGURE 2

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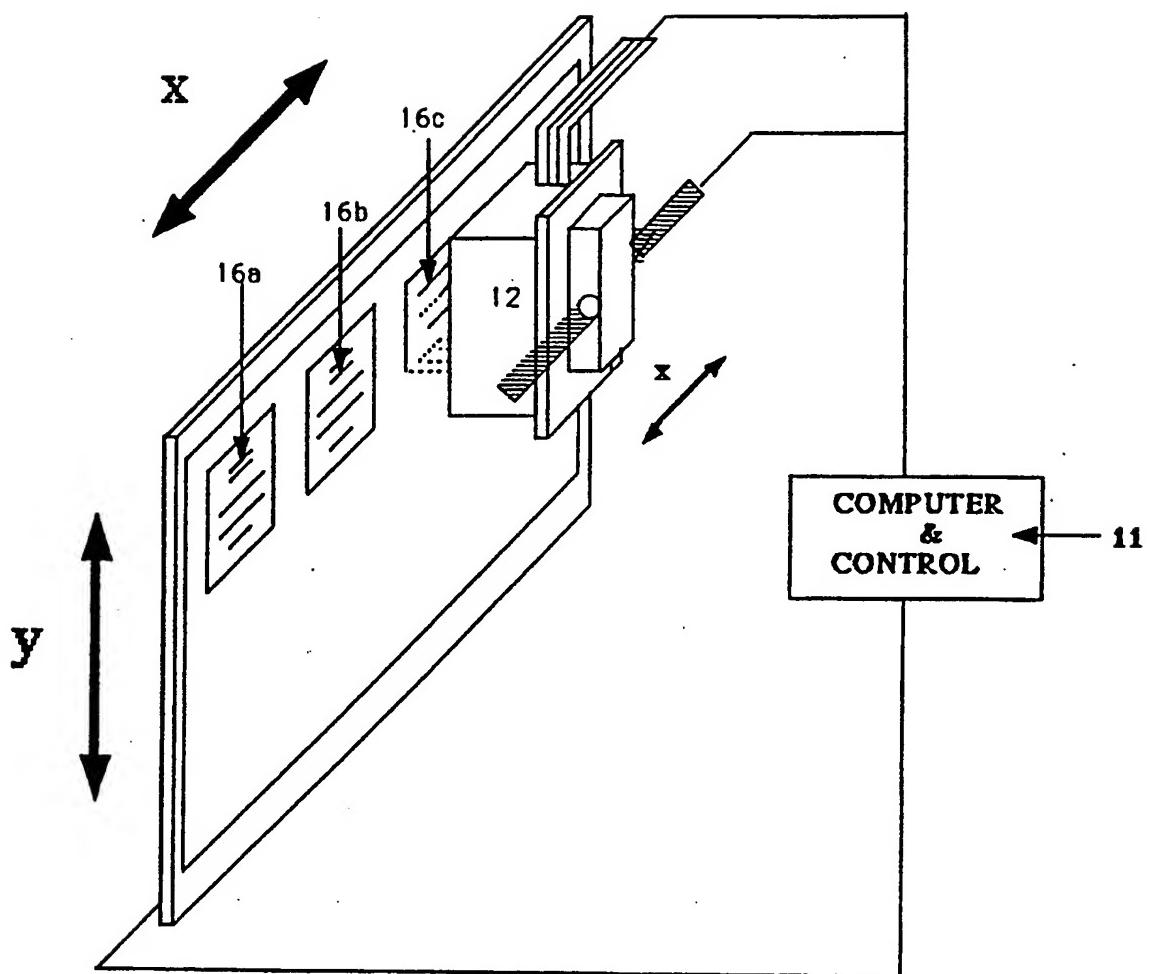
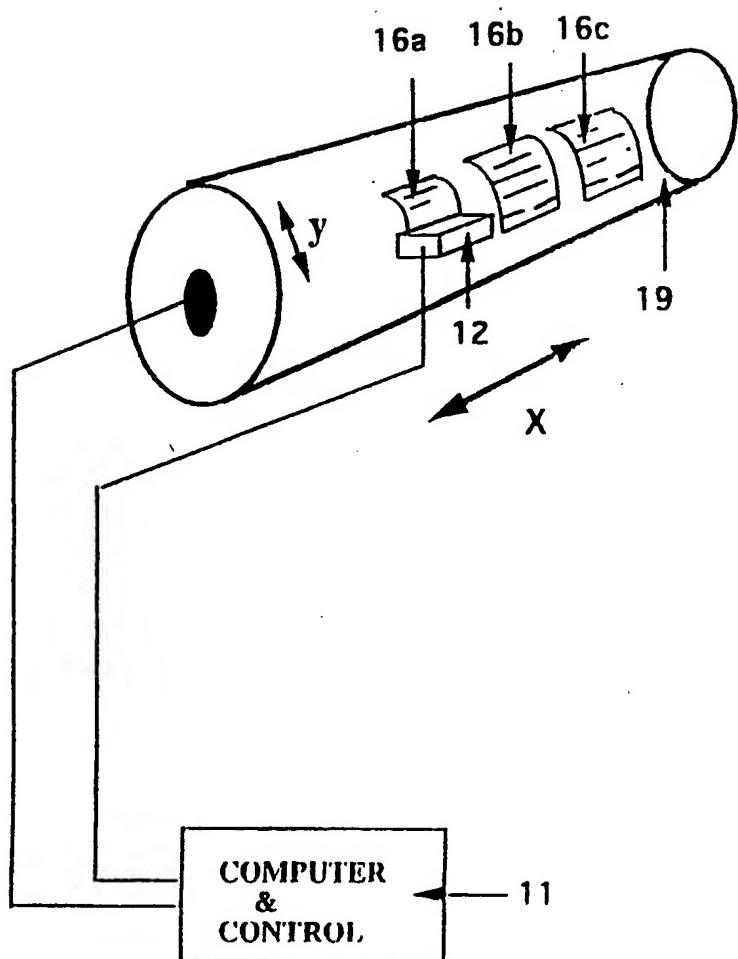


FIGURE 3

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**FIGURE 4****SUBSTITUTE SHEET**

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 93/11030

A. CLASSIFICATION OF SUBJECT MATTER

B 41 C 1/10, B 41 J 2/01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B 41 C, B 41 J, G 01 D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4 833 486 (ZERILLO) 23 May 1989 (23.05.89), the whole document (cited in the application). --	1, 4, 9, 12, 13
X, P	DE, A1, 4 119 111 (INSTITUT FÜR GRAFISCHE TECHNIK ZENTRAL GMBH) 17 December 1992 (17.12.92), the whole document. --	1, 4, 9, 12, 13
A	EP, A2, 0 242 083 (MICRODYNAMICS) 21 October 1987 (21.10.87), fig. 1; abstract. --	1-4, 9- 13
A	GB, A, 2 152 436 (BOWTHORPE-HELLERMANN LTD)	5, 8

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

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Date of the actual completion of the international search

15 February 1994

Date of mailing of the international search report

21.03.94

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INTERNATIONAL SEARCH REPORT

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International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	04 January 1985 (04.01.85), fig. 2; abstract. -----	

ANHANG

zur internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

ANNEX

to the International Search Report to the International Patent Application No.

ANNEXE

au rapport de recherche international relatif à la demande de brevet international n°

PCT/US 93/11030 SAE 82199

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Orientierung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

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Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
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